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ABSTRACT

This course guide for a transportation course is one of four developed for the energy/power area in the North Dakota senior high industrial arts education program. (Eight other guides are available for two other areas of Industrial Arts--graphic communications and production.) Part 1 provides such introductory information as a definition and instructional objectives for Industrial Arts. Part 2 contains the course rationale and objectives; guidelines for implementation; taxonometric structure; course description including length, credit, prerequisites, and student competencies; suggested instructional units with required number of class periods; and 14 units. Each unit includes some or all of the following material: unit objective(s), topic outline, and selected student competencies to be developed through sample coordinated learning activities. Unit titles are Introduction to Transportation Technology, Early Developments in Transportation, Transportation--Productive System, Classification of Technical System, Terrestrial Mode (Random Route), Terrestrial Mode (Fixed Route), Stationary Conveyance Systems, Marine Modes of Transportation, Space Transportation and Vehicles, Transportation and the Future, Energy and Transportation, Transportation and the Environment, and Occupational Information. A reference list is appended. (YLB)

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NORTH DAKOTA SENIOR HIGH
INDUSTRIAL ARTS
CURRICULUM GUIDES

TRANSPORTATION

(ENERGY / POWER)

INDUSTRIAL ARTS
SENIOR HIGH--LEVEL II

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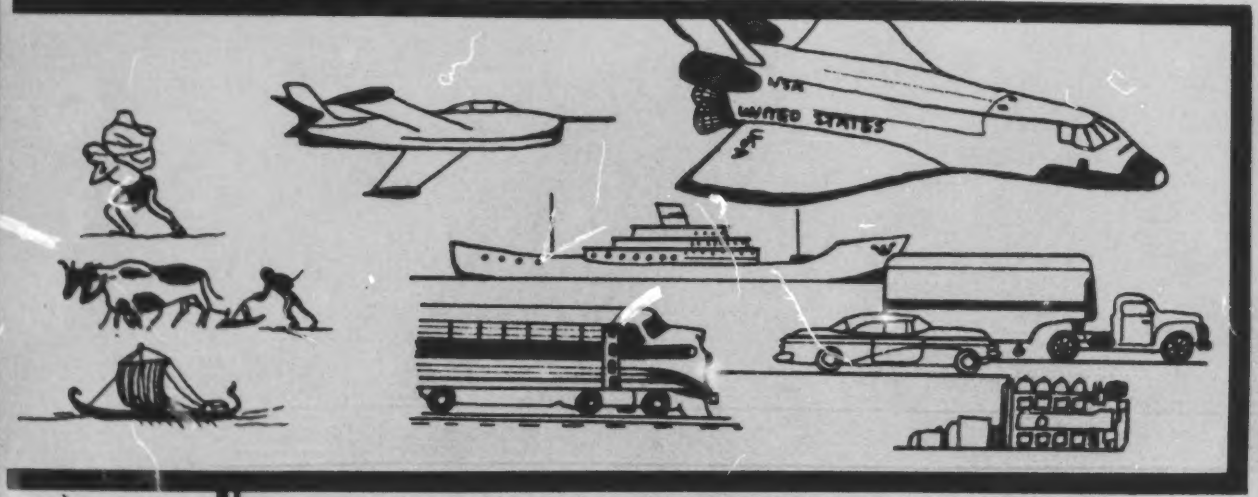

NORTH DAKOTA

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NORTH DAKOTA STATE BOARD FOR
VOCATIONAL EDUCATION
Bismarck, North Dakota

NORTH DAKOTA SENIOR HIGH INDUSTRIAL ARTS CURRICULUM GUIDES

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Supported by
The North Dakota State Board For Vocational Education
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PREFACE

One of the biggest challenges facing education today is keeping the instructional content current. Industrial Arts in particular must be quick to respond to changes in our technological society. For many years, North Dakota has offered quality industrial arts programs to students in the public schools. Credit for this is due to the teachers who have shown the desire to continually improve programs, keep their content current, and make instruction relevant.

The Industrial Arts curriculum has boundless potential for courses and program development. However, this program possibility excites the imagination of teachers to offer endless number of courses which causes a need to determine what is of greatest value for students to experience.

Thus, the development of an appropriate or model curriculum requires a critical examination of several undergirding questions: What is the overall responsibility of Industrial Arts? What Industrial Arts goals are appropriate for the different grades or school levels? What courses constitute a meaningful curriculum for these goals to be realized? What shall be the scope and sequence of the total curriculum? The answers to these questions have been addressed by a North Dakota Industrial Arts Master Plan curriculum committee and are recorded in the North Dakota Senior High Industrial Arts Program of Studies booklet.

The Program of Studies describes the complete secondary school industrial arts education. The Program of Studies Booklet emphasizes the Level II Senior High programs with specific courses, course descriptions, objectives and units of instruction. The Junior High-Level I programs is dealt with in a general basis for the purpose of articulating the two levels within the total secondary school industrial arts program.

Three types of Industrial Arts programs are included in the Program of Studies along with the individual courses which constitute the complete secondary school curriculum:

1. ORIENTATION AND EXPLORATION-- Level I program designed for grades seven through nine. The purpose of this program is to provide students with first-hand exploratory experiences in the four technical cluster areas. The learning experiences should provide an awareness of the impact of industry and it's associated technologies on the lives of individuals. Furthermore, this program assists individuals in making informed and meaningful occupational/career choices.
2. PERSONAL ENRICHMENT-- The program designed to prepare students with a general education of technolgical literacy, avocational skills and consumer information. This is purely an elective program of students for students who desire to gain an understanding of the technical concepts for personal satisfaction.
3. PRE-TECHNICAL-- This program provides concentrated and specialized technical courses for grades ten through twelve. These courses are articulated with the Level I technical cluster areas. Students at this level have a wide range of interests, abilities, and life aspirations. Therefore, the key element for the senior high pre-technical program is flexibility to meet the varied needs of learners. The program is designed to prepare students for advanced educational or training programs.

The North Dakota Senior High Program of Studies identified twelve different courses recommended to be offered in grades ten, eleven and twelve. The model curriculum lists four courses for each of three technical areas: (1) Energy/Power,(2) Graphic Communications, and (3) Production. Individual course guides have been developed for each of the twelve courses recommended for the senior high curriculum. This being one of the twelve course guides. Similar guides have been developed for the remaining eleven.

Each course guide contains the course rationale, objectives,content, units and selected student competencies to be developed along with student learning activities. The primary aim of the course guides is to provide meaningful direction and still leave opportunity for individual teacher creative approaches in meeting the diverse needs of unique school populations. The course guides not only proposes to assist teachers and administrators in keeping their programs up-to-date, but also to promote industrial arts education program unifc.mity among North Dakota schools.

Ernest Breznay

Ernest Breznay
State Industrial Arts Supervisor
North Dakota State Board for Vocational Education
July, 1981

ACKNOWLEDGEMENTS

The North Dakota Industrial Arts profession is indebted to the following individualr who gave their time and talents in the development of the Twelve Senior High Industrial Arts course guides. These teachers and teacher educators attended an Organizational meeting, participated in a curriculum writing seminar, and developed individual course guides during 1980 & 1981.

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BASIC BELIEFS ABOUT INDUSTRIAL ARTS

INDUSTRIAL ARTS IS .....

- an educational discipline founded upon the knowledge base of technology - the means by which material things are produced.
- an instructional program affording boundless opportunities for learning how technology has been, is now and will be basic to human desires and needs.
- a fundamental educational program that can serve educational priorities, whether they are academic education, general education, vocational education, career education, ad. inf.
- an activity based curriculum enabling students to learn through doing.
- logically a discipline with a curriculum continuum from grade K through 12.

INDUSTRIAL ARTS IS JUSTIFIED BECAUSE .....

- all persons need to know about the technological environment, the material culture, and industry because they are economically, socially and emotionally affected by them.
- all persons must make a career choice from an extremely large and increasing number of occupations that are affected by technology; therefore, they should have opportunities to develop interests, uncover talents, explore technical and applied science fields and study occupations.
- all persons must select, buy, use, and maintain the products of industry -- houses, automobiles, appliances, clothes, furniture and items of a never ending list. A knowledge of products, their manufacture, characteristics, advantages and disadvantages makes for intelligent consumption.
- all persons need recreational, leisure time and avocational outlets.
- all persons need to have opportunities to develop planning, creative, problem solving and technical skills in harmony with their inherent desire to seek the better way.

INDUSTRIAL ARTS CAN HELP THE STUDENT TO .....

- gain an understanding of industry and technology.
- discover interests and talents.
- develop techniques in problem solving.
- develop basic skills in the safe use of tools and machines.
- make informed and meaningful occupational choices.
- acquire interests in avocational pursuits and hobbies.
- develop safe working habits.
- apply other school subjects.
- become a wiser consumer.
- develop creativity.
- develop pride in work well done.
- work cooperatively with others.

THE INDUSTRIAL ARTS MISSION

The mission of Industrial Arts Education is to assist the student in developing an understanding about industry and technology and in the discovery and development of individual potential.

GOALS

Consistent with their abilities, interests and educational needs:

1. Industrial Arts students at the middle or junior high school level will be aware of employment and/or self-employment opportunities and requirements for use in making career choices and in determining their educational programs.
2. Industrial Arts students at the senior high school level will acquire technical competencies in preparation for advanced vocational or technical education programs.
3. Industrial Arts students at the senior high school level will acquire competencies that lead to responsible citizenship through technological understanding, consumer knowledge and the productive use of leisure time.

INDUSTRIAL ARTS: AN OFFICIAL DEFINITION

Industrial Arts education programs means those education programs which pertain to the body of related subject matter, or related courses, organized for the development of understanding about the technical, consumer, occupational, recreational, organizational, managerial, social, historical, and cultural aspects of industry and technology including learning experiences involving activities such as experimenting, designing, constructing, evaluating, and using tools, machines, materials, and processes which provide opportunities for creativity and problem solving or assist individuals in the making of informed and meaningful occupational choices or which prepare them for entry into advanced trade and industrial or technical education programs.

INDUSTRIAL ARTS INSTRUCTIONAL OBJECTIVES

Industrial Arts students at the Senior High School Level will acquire competencies that lead to responsible citizenship through technological understanding, consumer knowledge and the productive use of leisure time. The program stresses the following instructional objectives:

1. Develop an insight and understanding of industry and technology, its place in our society and the free enterprise system.
2. Discover and develop individual talents, aptitudes, interests, and potentials as related to industry and technology.
3. Develop an understanding of industrial processes and the practical application of scientific principles.
4. Develop technical problem-solving and creative abilities involving the use of materials, processes, and products of industry and technology.
5. Develop an understanding of industrial and technological career opportunities and their requirements and develop those traits which will help students obtain and maintain employment.

As determined by Title II of PL No. 94-482, the Vocational Education Act of 1976 and the State Board for Vocational Education, the purpose of funding industrial arts programs with vocational monies will be to:

1. Assist individuals in the making of informed and meaningful occupational and educational choices.
2. Prepare individuals for enrollment in advanced or highly skilled vocational and technical programs.

NORTH DAKOTA INDUSTRIAL ARTS CURRICULUM

Program Scope and Sequence Model

ELEMENTARY LEVEL
(k-6)
Awareness

At the elementary level, learning experiences in industrial arts will be directed primarily toward the child's development of an awareness of industry/technology and the world of work. The concepts and activities will be integrated with the elementary curriculum to enrich and reinforce the common learning areas.

JUNIOR HIGH LEVEL I
(7-9)
Orientation and Exploration

INSIGHTS INTO INDUSTRY & TECHNOLOGY

A broad overview of industry and technology. Learning experiences will be directed toward the student's exploration of the historical, present, and future potentials of industry and technology.

- GRAPHIC COMMUNICATIONS TECHNOLOGY
- MANUFACTURING TECHNOLOGY
- CONSTRUCTION TECHNOLOGY
- ENERGY/POWER TECHNOLOGY

SENIOR HIGH LEVEL II
(10-12)
Personal Enrichment
Pre-Technical

- DESIGN/DRAFTING
  PHOTOGRAPHY
  GRAPHIC ARTS
  CONSTRUCTION DRAFTING
  INDIVIDUAL TECHNICAL PROBLEMS
- PRODUCTION
  WOOD TECHNOLOGY
  PLASTIC TECHNOLOGY
  METAL TECHNOLOGY
  INDUSTRIAL CRAFTS
  INDIVIDUAL TECHNICAL PROBLEMS
- ENERGY SOURCES
  POWER TECHNOLOGY
  ELECTRICAL / ELECTRONIC TECHNOLOGY
  TRANSPORTATION TECHNOLOGY
  INDIVIDUAL TECHNICAL PROBLEMS

THE INDUSTRIAL ARTS PROGRAM OF STUDIES

LEVEL	GOAL	PROGRAM
II HIGH SCHOOL (Grades 10, 11, & 12)	1. Personal Enrichment 2. Pre-Technical	GRAPHIC COMMUNICATIONS TECHNOLOGY •Design/Drafting •Photography •Graphic Arts •Construction Drafting •Industrial Technical Problems ENERGY/POWER TECHNOLOGY •Energy Sources •Power Technology •Electrical/Electronic Technology •Transportation Technology •Individual Technical Problems PRODUCTION TECHNOLOGY •Wood Technology •Metal Technology •Plastic Technology •Industrial Crafts •Individual Technical Problems INDIVIDUAL TECHNICAL PROBLEMS (Multiple Offerings)
I JUNIOR HIGH SCHOOL (Grades 7, 8, &9)	1. Orientation 2. Exploration	•Insights into Industry and Technology •Graphic Communications Technology •Manufacturing Technology •Construction Technology •Energy/Power Technology

PROGRAM STANDARDS FOR INDUSTRIAL ARTS

ELEMENTS OF QUALITY INDUSTRIAL ARTS PROGRAMS

The success and quality of programs in industrial arts education depends upon elements that influence the quality of programs. Industrial arts must be responsive to the following elements:

A. GOALS AND OBJECTIVES: Program goals and objectives are established that provide the inspiration and guidance in program development, operation and evaluation.

B. INSTRUCTIONAL STAFF: The instructional staff is competent and meet necessary qualifications.

C. INSTRUCTIONAL PLAN: Selected subject matter is appropriate to learner's level and consistent with curriculum and course goals and objectives.

D. STUDENT ORGANIZATIONS: The establishment and operation of effective student organizations.

E. FACILITIES AND EQUIPMENT: Instructional facilities are well-designed, located and supportive of accomplishing curricular goals. (Refer to Educational Specifications for Industrial Arts Instructional Facilities Handbook, 1978.)

F. SPECIAL NEEDS: The program must provide for disadvantaged and handicapped students.

G. ADVISORY COMMITTEES: The establishment and effective use of industrial arts advisory committees.

H. GUIDANCE: The teacher's role in guidance.

I. ADMINISTRATION: Administration of the industrial arts program.

J. EVALUATION: Evaluation procedures are planned and implemented to assure continual program improvement.

NOTE: For further information on program standards, refer to the NORTH DAKOTA VOCATIONAL/TECHNICAL EDUCATION PROGRAM STANDARDS, Section 11.1 to 11.7.

INDUSTRIAL ARTS COURSE CODE NUMBERS
(Vocationally Funded)

Insights Into Industry and Technology	10001
Construction Technology	10011
Manufacturing Technology	10021
Wood Technology	10023
Metal Technology	10026
Plastic Technology	10029
Energy and Power Technology	10031
Electrical/Electronic Technology	10033
Energy Sources	10038
Power Technology	10039
Graphic Communications Technology	10051
Graphic Arts	10052
Design/Drafting	10053
Photography	10054
Construction Drafting	10056
Transportation	10061
Industrial Crafts	10080
Individual Technical Problems	10091
Individual Technical Problems	10092

PART II:

TRANSPORTATION COURSE GUIDE

(# 10061)

TRANSPORTATION TECHNOLOGY

Rationale:

Transportation is a technical adaptive system designed by people to efficiently utilize resources to obtain time and place utility and to attain and maintain direct physical contact and exchange among individuals and societal units through the movement of materials/goals and people.

The study of transportation technology in industrial arts education is designed to promote technological literacy in transporting technical means and assist individuals in making informed and meaningful occupational choices in the transportation industries. In the exploration of transportation technology students will have the opportunity to develop an awareness of the industry and the changes it brings to an evolving society. The application of the program will assist students in developing the technical competencies, and an understanding of the concepts and principles which are common to the human endeavors involved in the act of transporting goods and people.

Course Objectives:

(1) Develop technical problem-solving and creative abilities involving the use of materials, processes, and products in the study of transportation technology.

(2) Develop an insight into the technical and social/cultural problems related to transportation in our society.

(3) Develop an awareness of occupational preparation programs, career opportunities and their requirements, for making career choices in the area of transportation.

Guidelines For Implementation

Success in the classroom or laboratory depends on many factors. Foremost among these is the planning effort on the part of the teacher. Educational programs must be flexible and adaptable. They must be flexible enough to remain adaptable to all locales, in numerous types of facilities, and with students possessing differing values and interest. Therefore, a successful program must be capable of application in both small and large schools.

The industrial arts program recommended by these course guides are designed to meet individual student needs. They provide teachers with guidelines for a well balanced program with suggested teacher options in each of the three major technical study areas: (1) Graphic Communications; (2) Energy/Power; and (3) Production. The North Dakota secondary school industrial arts program suggests three levels of learning with an alternative curriculum approach at the Level II for those schools that cannot offer specific courses identified for each of the three technical study areas due to the size of enrollments or other limiting factors.

The recommended scope and sequence of course offerings for the energy/power technical study area is illustrated on the sample program model on page 13. The Level I Energy/Power Technology course serves as an orientation and exploration experience. It is recommended as a prerequisite to the four Level II courses. The senior high Level II courses provide concentrated and indepth exploratory experiences in four study areas related to energy/power: (1) Energy Sources; (2) Power Technology; (3) Electrical/Electronic Technology; and (4) Transportation Technology. Since students at the senior high level display a wide range of interest, abilities, and life goals, the industrial arts program must provide a variety of learning experiences and course options to meet individual student needs, it is recommended that the specific course options be made available to students when possible. For the smaller mid-sized schools, it may not be feasible to offer all four of the specific courses identified for Level II. If that should be the case, it is recommended that one or two of the courses be offered and supplemented by an ITP (Individual Technical Problems) course as a Level II alternative. (See ITP Course specifications on page 14.) This course is designed to provide multiple learning experiences in the technical area of energy/power to meet individual needs of students.

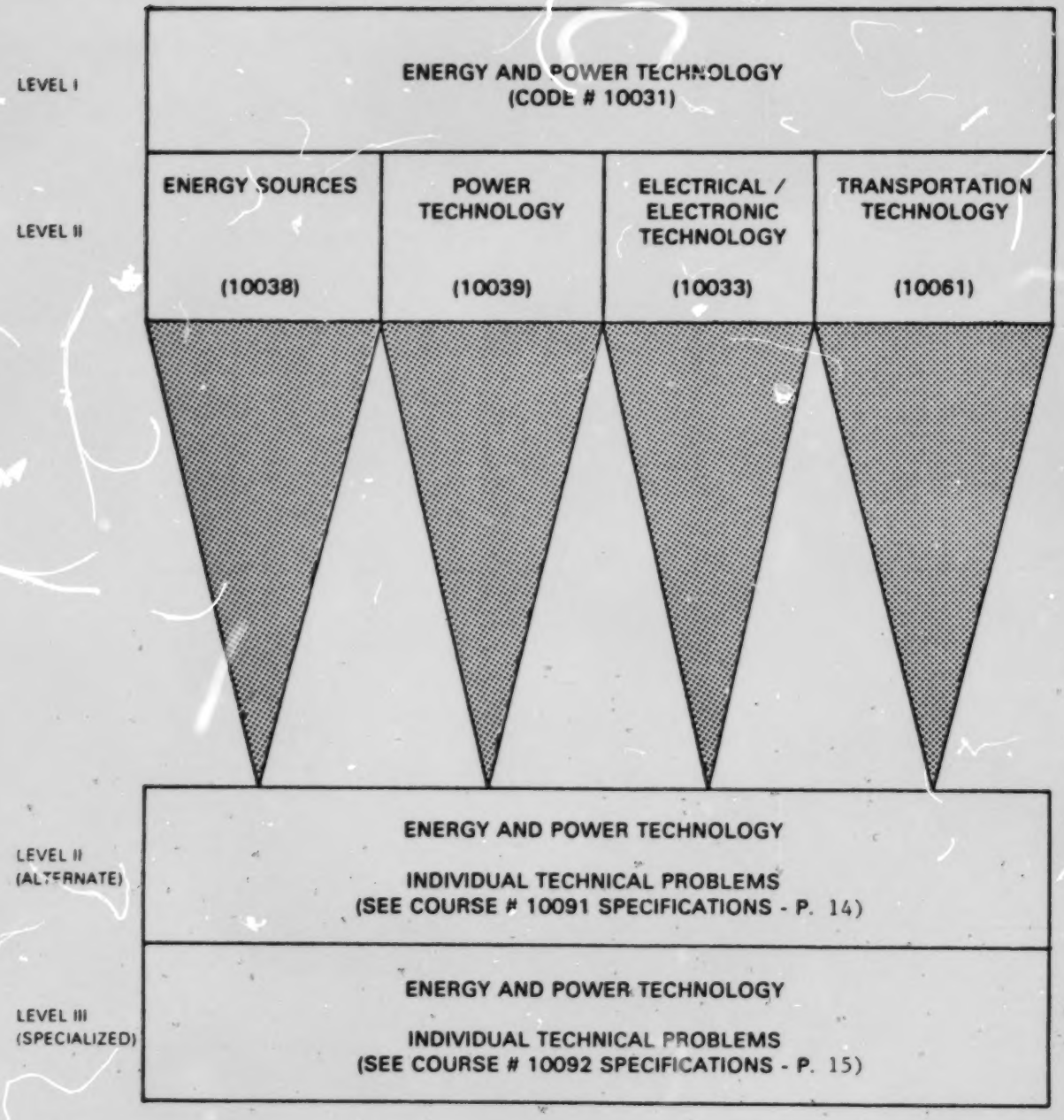
The Level III ITP specialized course (Code #10092) is suggested for students in larger programs who have had the Level II indepth exploratory courses in energy/power and desire to study a specialized aspect related to any phase of energy/power technology. The student may select a technical problem in such areas as alternate energy sources, energy conversion, transmission, and others. (See pages 15 and 16 for the specific ITP specialized course specifications and technical problem options).

Guidelines For Implementing the Transportation Technology Course

This course guide is designed to assist teachers, supervisors, administrators, and teacher-educators as they organize an industrial arts course in transportation technology within the energy/power technical area in the State of North Dakota.

The course guide provides the instructor with suggested procedures, learning activities, content, and course resources to assist in setting up a program of study based on student needs. It is a fact, the school day is limited in time and it is difficult to locate and acquire the vast amount of available materials. This course guide assists the instructor in providing a knowledge structure with specific concepts to be taught. The instructor may choose those concepts most appliable to his or her specific teaching situation. Consequently, the course content may be expanded and/or modified as deemed necessary to provide students with viable content and learning activities.

The implementation of a course in transportation technology will not require large amounts of additional or expensive instructional equipment. Texts indicated in this guide are used only as examples. The instructor may select the text most appropriate for his or her needs.



Sample Program Model

INDIVIDUAL TECHNICAL PROBLEMS

COURSE CODE: 10091

This individual technical problem course is designed for students who have not had the opportunity to enroll in specific Level II subject matter courses in the Energy/Power Technology cluster area. The course is designed to provide a means for meeting individual student needs through the offering of multiple activities in a number of technical areas in schools where separate courses are not available.

INDUSTRIAL ARTS PURPOSE

Personal Enrichment

Pre-Technical

GRADE LEVEL

11 - 12

COURSE LENGTH

One period per day

18 or 36 weeks

UNIT OF CREDIT

½ or 1 unit

RECOMMENDED PREREQUISITES

Level I Curriculum Courses

SELECTED STUDENT COMPETENCIES

NOTE: Individual student competencies and learning experiences are to be identified and developed on a contractual basis by the student and approved by the instructor for each problem.

SAMPLE LEARNING TOPICS

NOTE: Learning topics for the ITP are to be selected from the instructional units identified for each specific subject matter course. These courses include:

ENERGY/POWER:

-- Energy Sources, 10038
-- Power Technology, 10039
-- Electrical/Electronic Technology, 10033
-- Transportation Technology, 10061

INDIVIDUAL TECHNICAL PROBLEMS: ENERGY/POWER

COURSE CODE 10092

This individual technical problems course is designed for students who have had the Level II preliminary course of this cluster in the chosen area of study and intend to study specific advanced topic(s) in energy sources, power technology, electrical/electronic technology and/or transportation technology.

INDUSTRIAL ARTS PURPOSE

Personal Enrichment

Pre-Technical

GRADE LEVEL

11 - 12

COURSE LENGTH

One period per day

18 or 36 weeks

UNIT OF CREDIT

½ or 1 unit

RECOMMENDED PREREQUISITES

See Course Description

SELECTED STUDENT COMPETENCIES

Instruction in this industrial arts course is open to meet students needs. The following suggested objectives are meant to provide ideas for developing the student's program.

1. To prepare students for seeking advanced education in the area of energy/power.
2. To provide students the experiences in problem-solving, research and development, and technical report writing with regard to any chosen topic in energy/power.
3. To provide students with opportunities for exploration in energy/power systems and the practical application of scientific principles related to these systems.
4. To provide students with a broader understanding of career opportunities in energy/power.

10092
COURSE CODE

INDIVIDUAL TECHNICAL PROBLEMS:

ENERGY/POWER

SAMPLE LEARNING UNITS

ENERGY SOURCES:

I. Gasahol Production
II. Solar Heating and/or Cooling
III. Solar Photovoltaic Banks
IV. Wind or Water Energy Conversion Systems
V. Energy Storage Systems

POWER TECHNOLOGY:

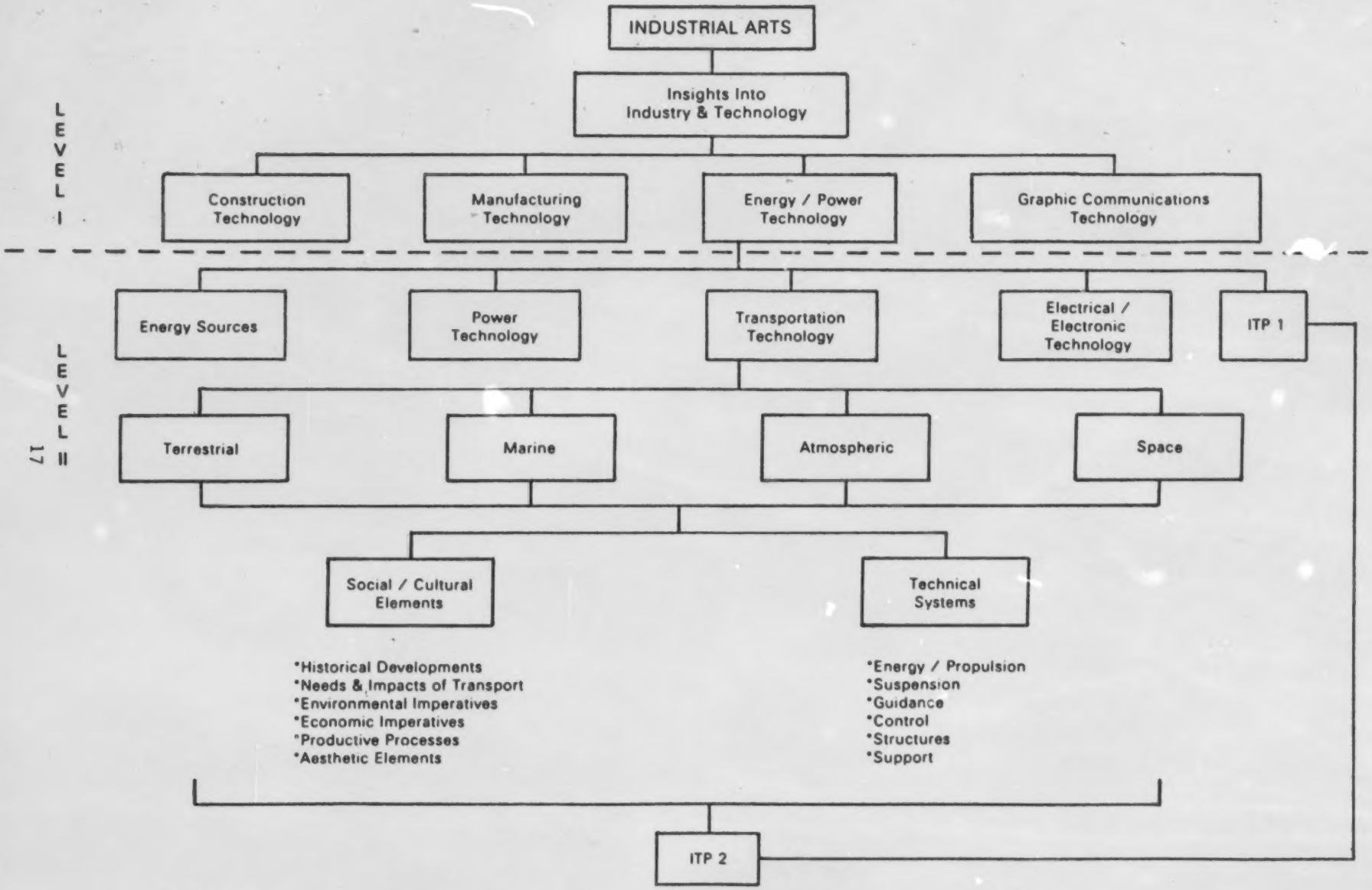
I. Stirling Engine/Heat Pump
II. Steam Engine
III. Dynomometers for System Analysis
IV. Hydraulic/Pneumatic Controls

ELECTRICAL/ELECTRONIC TECHNOLOGY:

I. Amateur Radio
II. Alarm Systems
III. Trouble Shooting Communications Equipment
IV. Vehicular and Other Microprocessor Control Units

TRANSPORTATION TECHNOLOGY:

I. Electrical Vehicle Propulsion
II. Linear Induction Motor Propulsion
III. Air Suspension Systems


INDUSTRIAL ARTS
Insights Into Industry & Technology
LEVEL I
Construction Technology
Manufacturing Technology
Energy / Power Technology
Graphic Communications Technology
LEVEL II
Energy Sources
Power Technology
Transportation Technology
Electrical / Electronic Technology
ITP 1
Terrestrial
Marine
Atmospheric
Space
Social / Cultural Elements
Technical Systems
*Historical Developments
*Needs & Impacts of Transport
*Environmental Imperatives
*Economic Imperatives
*Productive Processes
*Aesthetic Elements
*Energy / Propulsion
*Suspension
*Guidance
*Control
*Structures
*Support
ITP 2

TRANSPORTATION TECHNOLOGY

COURSE CODE: 10061

This course is designed to provide students with the social/cultural developments related to efforts toward utilization of various modes of transportation to advance mobility. Emphases include the physical and human elements involved in the activities of people in the movement of themselves, their goods, or services from one point in a given environment to another point in the same or alternate environment.

INDUSTRIAL ARTS PURPOSE

Personal Enrichment

Pre-Technical

GRADE LEVEL

10 - 12

COURSE LENGTH

One period per day

18 weeks

UNIT OF CREDIT

½ unit

RECOMMENDED PREREQUISITES

None

SELECTED STUDENT COMPETENCIES

Experiences and activities of this industrial arts course should enable the student to:

1. Recall how energy is converted, transmitted, controlled, and applied to transportation systems.
2. Describe the basic operating principles of energy converters and how they can be applied to transportation systems.
3. Demonstrate safe practices in working with power systems, tools, and equipment.
4. Exhibit a willingness to use good work habits of orderliness, cleanliness, and care of property.
5. Identify, list and describe both technical and social/cultural problems related to transportation.
6. Interpret and analyze the technical systems used in transportation: (1) Energy source, (2) Propulsion, (3) Suspension, (4) Guidance, (5) Control, (6) Support.
7. Survey and discuss the environmental and energy imperatives that pertain to transportation technology.
8. Research and analyze the environmental divisions (terrestrial, marine, atmospheric, and space modes) of transportation technology.
9. Identify available occupational preparation programs related to transportation technology.

10061
Course Code

TRANSPORTATION TECHNOLOGY

Suggested Instructional Units

		Class Periods (18 wks) (36 wks)
I.	Introduction to Transportation Technology	3
II.	Early Developments in Transportation	4
III.	Transportation: Productive System	6
IV.	Classification of Technical System	10
V.	Terrestrial Modes (Random Route)	8
VI.	Terrestrial Modes (Fixed Route)	6
VII.	Stationary Conveyance Systems	8
VIII.	Marine Modes of Transportation	8
IX.	Atmospheric Modes of Transportation	8
X.	Space Transportation & Vehicles	6
XI.	Transportation & The Future	8
XII.	Energy & Transportation	6
XIII.	Transportation & The Environment	7
XIV.	Occupational Information	2
	TOTAL	90

UNIT I

Introduction to Transportation Technology

OBJECTIVES:

This unit is meant to provide the student with:

1. Knowledge of the history of transportation technology and its role in society.

2. Information to enable the student to identify and compare the environmental divisions of transportation technology.

3. Examples and comparisons of the major technical systems used in the various transportation modes.

1.0.0 History of Transportation

- 1.1.0 Elements of transportation
  - 1.1.1 Social/cultural
  - 1.1.2 Technical components
- 1.2.0 Early developments in time & place utility
- 1.3.0 The role of transport technology
- 1.4.0 The development of various modes.

2.0.0 Environmental Mediums

- 2.1.0 Terrestrial characteristics & techniques
  - 2.1.1 Wheeled
  - 2.1.2 Air cushion
  - 2.1.3 Magnetic
  - 2.1.4 Aerial tramway
  - 2.1.5 Conveyor belts
  - 2.1.6 Roller lines
  - 2.1.7 Pipeline
- 2.2.0 Marine characteristics & techniques
  - 2.2.1 Hydrofoil
  - 2.2.2 Sub-surface
  - 2.2.3 Sail
- 2.3.0 Atmospheric characteristics & techniques
  - 2.3.1 Lighter than air
  - 2.3.2 Heavier than air

2.4.0 Space characteristics & techniques

- 2.4.1 Manned vehicles
- 2.4.2 Un-manned vehicles

3.0.0 Technical Systems

3.1.0 Propulsion systems

- 3.1.1 Linear induction
- 3.1.2 Jet
- 3.1.3 Propeller
- 3.1.4 Rocket
- 3.1.5 Pneumatic
- 3.1.6 Gravity
- 3.1.7 Vacuum
- 3.1.8 Internal & external combustion engines

3.2.0 Guidance systems

- 3.2.1 Rail
- 3.2.2 Mechanical
- 3.2.3 Electronic

3.3.0 Control systems

- 3.3.1 Vehicular control
- 3.3.2 System control

3.4.0 Suspension systems

- 3.4.1 Mechanical
- 3.4.2 Fluid (air/water)
- 3.4.3 Magnetic

3.5.0 Structural systems

- 3.5.1 Vehicular construction materials
- 3.5.2 Bridge construction materials, design
- 3.5.3 Roadway construction
- 3.5.4 Vehicular design considerations

3.6.0 Support systems

- 3.6.1 Operations
- 3.6.2 Economic
- 3.6.3 Maintenance

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT I: Introduction to Transportation Technology

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Identify and describe the role of transportation in society on a historical timeframe.	A.1 Define transportation technology as human technical endeavor.
	A.2 Trace the development of transportation modes based upon environmental medias.
	A.3 Identify the various modes of transportation that are being utilized at the local level.
B. Distinquish between personalized and public forms of transportation.	B.1 Identify three advantages of both personalized and public modes of transportation.
C. Identify and describe the four transport environmental mediums.	C.1 List three unique characteristics for each of the four environmental mediums.
D. Recognize the role and function of the six technical systems used by all modes of transportation.	D.1 Select one mode of transportation and describe the basic function of each of the six technical systems.

UNIT II

Early Developments in Transportation

OBJECTIVES:

This unit is meant to provide the student with:

1. Information on human burden transport devices.
2. Knowledge pertaining to beast-of-burden devices.
3. Examples and comparisons of mechanical powered vehicles.

1.0.0 Human Burden Bearing Devices

- 1.1.0 Single yoke
- 1.2.0 Double yoke
- 1.3.0 Baskets
- 1.4.0 Travois
- 1.5.0 Carrying poles
- 1.6.0 Skis

2.0.0 Beast-of-Burden Devices

- 2.1.0 Pack animals
- 2.2.0 Yokes
- 2.3.0 Dragging
- 2.4.0 Travois
- 2.5.0 Sledges
- 2.6.0 Skis
- 2.7.0 Wheels

3.0.0 Mechanical Powered Devices

- 3.1.0 Steam engine
- 3.2.0 Bicycle
- 3.3.0 Steam locomotive
- 3.4.0 Tram and trolley bus
- 3.5.0 Paddle steamboat

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT II: Early Developments in Transportation

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Become familiar with early developments in transport technologies.	A.1 Prepare a report on the historical progression of human burden bearing devices.
B. Become familiar with the various techniques used as beast-of-burden transport.	B.1 Identify one beast-of-burden transport technique and show the mechanical advantage.
C. Understand the advantages of mechanical powered transport vehicles.	C.1 Prepare a written report on the developmental stages of a mechanical powered vehicle.

UNIT III

Transportation: A Productive System

OBJECTIVES:

This unit is meant to provide the student with:

1. An understanding of the productive--input/process/output model of transportation and its relationship to the systems of production & communication.

1.0.0 Analysis of the Transportation Productive Model Structure Inputs/Process/Outputs

1.1.0 Inputs of a Transportation System

1.1.1 People

1.1.1.1 Skills
1.1.1.2 Attitudes
1.1.1.3 Knowledge (personal)

1.1.2 Knowledge (accumulated)
1.1.3 Energy
1.1.4 Finance (money)
1.1.5 Capital (plant & equipment)

1.2.0 Processes in transportation

1.2.1 Receiving
1.2.2 Holding/storing
1.2.3 Loading
1.2.4 Transporting/moving
1.2.5 Unloading
1.2.6 Delivery to final destination

1.3.0 Outputs in transportation

1.3.1 Relocated goods
1.3.2 Relocated materials
1.3.3 Relocated people

2.0.0 Relationship of Transportation to Other Socio-Technical Systems

2.1.0 Communication system

2.2.0 Production system

2.2.1 Extractive industries

2.2.2 Agricultural industries

2.2.3 Manufacturing industries

UNIT III

2.2.4 Construction industries
2.2.5 Marketing/distribution

3.0.0 Managing the System (Managerial Processes)

3.1.0 Planning

3.2.0 Organizing

3.3.0 Directing

3.4.0 Controlling

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT III: Transportation: A Productive System

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Develop an understanding of transportation as a productive model in society.	A.1 Identify the input/process/-output components related to transportation.
	A.2 Identify one mode of transportation and trace the steps involved in the process from origin to final destination.
B. Understand the relationship of transportation to communication and productive human technical systems.	B.1 Provide an example on the the relationship of transportation with communications and show how they are inter-related.
	B.2 Make a case study of one local/state productive in industry and show the interfaces of transportation.

UNIT IV

Classification of Technical Systems

OBJECTIVES:

This unit is meant to provide the student with:

1. Recognition of the technical systems used in transportation technology.

2. Knowledge concerning the various options involved within each of the technical systems.

1.0.0 An Overview of Technical Systems Involved

- 1.1.0 Terrestrial modes
- 1.2.0 Marine modes
- 1.3.0 Atmospheric modes
- 1.4.0 Space modes

2.0.0 Propulsion Technical System

- 2.1.0 Elements of propulsion
  - 2.1.1 Energy source & stage
  - 2.1.2 Energy converters
  - 2.1.3 Transmission & power converters
  - 2.1.4 Efficiency of propulsion systems
  - 2.1.5 Behavioral characteristics

3.0.0 Suspension Technical System

- 3.1.0 Types of suspension
  - 3.1.1 Mechanical
  - 3.1.2 Magnetic
  - 3.1.3 Fluid types
    - 3.1.3.1 Aerostatic
    - 3.1.3.2 Hydrostatic
    - 3.1.3.3 Hydrodynamic
    - 3.1.3.4 Aerodynamic

4.0.0 Guidance Systems

- 4.1.0 Elements of guidance system

- 4.1.1 One-degree-of-freedom units
- 4.1.2 Two-degree of freedom units
- 4.1.3 Three-degree-of-freedom units

4.2.0 Guidance & navigation

- 4.2.1 Vehicular systems
- 4.2.2 Externally control systems

5.0.0 Control Systems

5.1.0 Vehicular control

- 5.1.1 Information
- 5.1.2 Actuators
  - 5.1.2.1 Mechanical
  - 5.1.2.2 Fluid
  - 5.1.2.3 Electrical

5.2.0 System control

- 5.2.1 Regulatory measures
- 5.2.2 Traffic control deviees

6.0.0 Structure & Support Systems

6.1.0 Fixed & vehicular structure
6.2.0 Life & vehicular support systems

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT IV: Classifications of Technical Systems

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Become familiar with the six functional technical systems of transportation.	A.1 Define and give examples for each of the six technical systems. - propulsion - guidance - suspension - control - structure - support
B. Understand the propulsion systems: (The process of causing a body to move by exerting a natural or mechanical force).	B.1 Measure and observe the static thrust of a model solid fuel rocket engine with a Static Rocket Test Unit. B.2 Analyze model pulse jet performance through conducting experiments on a pulse jet test unit. B.3 Conduct experiments to measure small 2/4 cycle heat engine performance using various types of fuel on an electric dynamometer/generator. B.4 Observe and analyze linear induction electric motor propulsion with the use of an eletric powered curtain rod unit.

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT IV: Classification of Technical Systems

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
	B.5 Observe and analyze the operation of an external combustion converter with the use of a model steam engine.
	B.6 Conduct experiments to illustrate fluid, mechanical, and electrical form of power transmission.
C. Become familiar with the Suspension System: (Methods employed to suspend a vehicle in or on a given environmental medium).	C.1 Study and analyze the mechanical, fluid and magnetic suspension systems employed in vehicular suspension.
	C.2 Fabricate a wind tunnel to test and observe student constructed aerodynamically designed vehicles and components. The wind tunnel should be a tunnel-like chamber through which air can be forced at controlled velocities to study the airflow measured by a monometer at various points to illustrate Bernoulli's principle.
	C.3 Fabricate a vehicle path using magnets to suspend a vehicle along a pathway magnetically.

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT IV: Classification of Technical Systems

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
	C.4 Construct a pathway with air injection to illustrate air suspended vehicles.
D. Become familiar with the Guidance System: (Information required to control a vehicle or vehicular system to operate in a prescribed path).	D.1 Fabricate various types of pathway guidance systems used in terrestrial, marine and atmospheric modes of transportation.
	D.2 Visit a local airport and railroad station to view guidance systems employed.
E. Understand the Control Systems: (The mechanical or automated procedures used to control a vehicle and/or vehicular system.	E.1 Study, analyze, and discuss the various manual and automated control systems employed to direct a vehicle on a path.
	E.2 Study the control of the movement of vehicles and the associated technical systems used to facilitate traffic flow.
F. Become familiar with the various types of Support System: (Categories related to operations, economic and maintenance support of transportation).	F.1 Study and discuss the total transportation operation, economic, maintenance support systems of transportation.
G. An understanding of the Structural System: (The structural makeup and design of vehicles and other systems physical components).	G.1 Test vehicular construction materials to study the buoyancy characteristics for a variety of materials.

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT IV: Classification of Technical Systems

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	G.2 Study, design, and construct various types of bridges and test for bearing loads. G.3 Construct a tube structure and vehicle to test gravitational and vacuum means of propulsion. G.4 Construct a hovercraft whereby the structure is air suspended by a fan attached to the shaft of small engine and enclosed in a skirted shroud. G.5 Fabricate model aircraft and space vehicles using appropriate design, materials and control features.

UNIT V

Terrestrial Mode (Random Route)

OBJECTIVES:

This unit is meant to provide the student with:

1. Exposure to the various modes of transportation for any given random route.
2. Basic principles concerning the operational aspects of the various modes.
3. The opportunity to interpret and understand the various technical systems used.

1.0.0 Terrestrial Mode (Random Route)

- 1.1.0 Carriages
- 1.2.0 Bicycles
- 1.3.0 Motorcycle
- 1.4.0 Automobile
- 1.5.0 Trucks and buses
- 1.6.0 Roadways
- 1.7.0 Recreational vehicles
- 1.8.0 Technical systems
  - 1.8.1 Propulsion
  - 1.8.2 Guidance
  - 1.8.3 Control
  - 1.8.4 Suspension
  - 1.8.5 Structure
  - 1.8.6 Support

2.0.0 Personalized & Public Transportation Systems

3.0.0 Advantages & Disadvantages for each Transport Mode

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT V: Terrestrial Modes (Random Route)

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Identify and list the various modes of transportation for any given random route.	A.1 View films on various random route vehicles.
B. List some of the basic principles concerning the operation of the various modes.	B.1 Identify the advantages & disadvantages for a selected transport mode.
C. Give examples of how the six major technical systems are utilized in the random route mode.	C.1 Class discussion on technical systems relationship to random route vehicles.

UNIT VI

Terrestrial Mode (Fixed Route)

OBJECTIVES:

This unit is meant to provide the student with:

1. Exposure to the various modes of transportation for any given fixed route.
2. Information relating to rail rapid transit systems currently being utilized.

1.0.0 Terrestrial Mode (Fixed Route)

- 1.1.0 Trolley
- 1.2.0 Rail Transportation
  - 1.2.1 Group rapid transit
  - 1.2.2 Shuttle and loop transit
  - 1.2.3 Personal rapid transit

1.3. 1.3.0 Technical systems

- 1.3.1 Propulsion
- 1.3.2 Guidance
- 1.3.3 Control
- 1.3.4 Suspension
- 1.3.5 Structure
- 1.3.6 Support

2.0.0 Characteristics of Fixed Route Transport Modes

- 2.1.0 Functional characteristics
- 2.2.0 Environmental imperatives

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT VI: Terrestrial Mode (Fixed Route)

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Relate the history of the trolley.	A.1 Classroom discussion period.
	A.2 Class discussion, class visitation to local train depot, station etc.
B. List and describe some of the advantages of rail transportation.	B.1 Calculate the cost of moving "X" lbs. by rail vs. roadway (cost of fuel included). Local railway may be able to help with their costs.
C. List and describe some of the newer applications of rail transportation.	C.1 View films on BART, G.R.T. and P.R.T.

UNIT VII

Stationary Conveyance Systems

OBJECTIVES:

This unit is meant to provide the student with:

1. Information relating to the theory of operation and maintenance of various types of stationary conveyance
2. Exposure to the forms of implementation of stationary conveyance systems.
3. Experimentation on various stationary conveyance systems.

1.0.0 Stationary Conveyance Systems

- 1.1.0 Pipelines
  - 1.1.1 Fluid (gas/liquid) movement
  - 1.1.2 Movement of solids suspended in liquids
  - 1.1.3 Pump movement
  - 1.1.4 Gravitational movement
- 1.2.0 Conveyor belts
  - 1.2.1 Movement of goods
  - 1.2.2 Movement of sub-assemblies
  - 1.2.3 Roller lines
- 1.3.0 Elevators and Escalators
  - 1.3.1 Movement of people
  - 1.3.2 Movement of goods
- 1.4.0 Technical systems
  - 1.4.1 Propulsion
  - 1.4.2 Guidance
  - 1.4.3 Control
  - 1.4.4 Suspension
  - 1.4.5 Structure
  - 1.4.6 Support

2.0.0 Application of Stationary Conveyance Systems

- 2.1.0 Extractive industries
- 2.2.0 Agricultural industries
- 2.3.0 Manufacturing industries
- 2.4.0 Distribution centers

3.0.0 Advantages & Disadvantages of Stationary Conveyance Systems

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT VII: Stationary Conveyance Systems

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Explain the theory of operation of the pipeline mode.	A.1 Construct a scale model using 2-3" clear plastic pipe.
	A.2 Experiment with slurry, gas and liquid transfer.
B. Study several uses for the conveyor belt mode.	B.1 Visit a local industry if available and see mode in operation; Discuss.
C. Study the advantages of these modes of transportation.	C.1 Class discussion, relate class experiences with these modes.
D. Identify technical system applications to this mode.	D.1 Discuss 6 technical systems as they relate to this mode.

UNIT VIII

Marine Modes of Transportation

OBJECTIVES:

This unit is meant to provide the student with:

1. Information relating to the advantages and disadvantages of marine modes of transportation.

2. Historical aspects of marine modes of transportation.

3. Information on the various technical systems of marine transportation.

1.0.0 Marine Modes of Transportation

- 1.1.0 Mechanical powered units
  - 1.1.1 Ships
  - 1.1.2 Tankers (standard and super)
  - 1.1.3 Barges
  - 1.1.4 Hovercraft
  - 1.1.5 Water jet
  - 1.1.6 Air propulsion
- 1.2.0 Canals and inland waterways
  - 1.2.1 Channels
    - 1.2.1.1 Erie
    - 1.2.1.2 Suez
    - 1.2.1.3 St. Lawrence
  - 1.2.2 Locks
  - 1.2.3 Gates
- 1.3.0 Maritime waterways
- 1.4.0 Technical systems
  - 1.4.1 Propulsion
  - 1.4.2 Guidance
  - 1.4.3 Control
  - 1.4.4 Suspension
  - 1.4.5 Structure
  - 1.4.6 Support

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT VIII: Marine Modes of Transportation

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. List advantages and disadvantages of marine transportation.	A.1 Class discussion, student research.
B. Identify, list and/or describe several of the more recent innovations in this mode.	B.1 Construct a model of a hovercraft using a platform, small gas engine and ground shroud.
C. Identify and list some of the design considerations in construction of canals and waterways.	C.1 Class could assemble small plastic models available.
D. Identify technical system application to this mode.	D.1 Class discussion. D.2 Select various materials used in the construction of marine vehicles and test the buoyancy of the material. D.3 Construct a model boat or ship incorporating necessary technical systems.

UNIT IX

Atmospheric Modes of Transportation

OBJECTIVES:

This unit is meant to provide the student with:

1. Information relating to the advantages and disadvantages of atmospheric modes of transportation.

2. An overview of the history of atmospheric modes of transportation.

3. Information on the technical systems involved in atmospheric transportation.

1.0.0 Atmospheric Modes of Transportation

- 1.1.0 Lighter -than-air crafts
  - 1.1.1 Airships
  - 1.1.2 Balloons
- 1.2.0 Heavier -than-air crafts
  - 1.2.1 Fixed wing
    - 1.2.1.1 Traditional aircraft
    - 1.2.1.2 Supersonic transport
  - 1.2.2 Rotary wing
    - 1.2.2.1 Helicopter
    - 1.2.2.2 VTOL
    - 1.2.2.3 STOL
- 1.3.0 Airports and Elements
- 1.4.0 Technical systems
  - 1.4.1 Propulsion
  - 1.4.2 Guidance
  - 1.4.3 Control
  - 1.4.4 Suspension
  - 1.4.5 Structure
  - 1.4.6 Support

2.0.0 Characteristics of Atmospheric Modes

- 2.1.0 Functional characteristics
- 2.2.0 Environmental characteristics

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT IX: Atmospheric Modes of Transportation

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Provide an understanding of the several components in involved in the air transportation system.	A.1 Define the concept "Atmospheric Mode of Transportation".
	A.2 List the components of the air transportation system.
B. Develop an understanding of the two major types (lighter--than-air) transport modes.	B.1 Identify and describe two examples of the two major classification of atmospheric systems.
C. Become familiar with the six technical systems involved within an air transportation system.	C.1 Study and describe the basic systems of propulsion used in atmospheric systems.
	C.2 Construct a model VOR station.
	C.3 Illustrate the forces acting on an aircraft in flight and identify the controlling components.
D. Design and understand the airport facilities used to support the transportation system.	D.1 Design an airport complete with control tower to baggage handling.
E. Become familiar with the various materials and techniques used in aircraft vehicle construction.	E.1 Design and construct a model aircraft incorporating as many components as possible.
F. Study the principles involved in airport management.	F.1 Visit an airport.

UNIT X

Space Transportation and Vehicles

OBJECTIVES:

This unit is meant to provide the student with:

1. Information on the past and future use of space transportation.

2. The opportunity to explore the technical systems used in space transportation.

1.0.0 Space Transportation and Vehicles

- 1.1.0 Manned systems
  - 1.1.1 Space exploration
  - 1.1.2 Space shuttle
- 1.2.0 Unmanned systems
  - 1.2.1 Space exploration
  - 1.2.2 Satellites
  - 1.2.3 Defense
- 1.3.0 Technical systems
  - 1.3.1 Propulsions
  - 1.3.2 Guidance
  - 1.3.3 Control
  - 1.3.4 Suspension
  - 1.3.5 Structure
  - 1.3.6 Support

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT X: Space Transportation and Vehicles

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Identify, list and/or describe several manned systems of space transportation.	A.1 Study and discuss material requested from N.A.S.A. and U.S. Dept. of Transportation.
B. List several examples of unmanned space transportation.	B.1 Describe the operating characteristics of satellites.
C. Identify the technical systems of space transportation and space vehicles.	C.1 Design, construct & test a model rocket.

UNIT XI

Transportation and the Future

OBJECTIVES:

This unit is meant to provide the student with:

1. Some of the possible future developments in the area of transportation, some being developed, some still in the planning stages.

2. Information about some of the changes in the technical systems for the future.

1.0.0 Urban Transit

- 1.1.0 Group rapid transit (GRT)
- 1.2.0 Shuttle and loop transit (SLT)

2.0.0 Personal Rapid Transit (PRT)

3.0.0 Transportation in Space

4.0.0 Technical Systems

- 4.1.0 Propulsion
- 4.2.0 Guidance
- 4.3.0 Control
- 4.4.0 Suspension
- 4.5.0 Structure
- 4.6.0 Support

5.0.0 Environmental Imperatives

6.0.0 Other Developments

- 6.1.0 Moving sidewalks
- 6.2.0 Quiet short-haul aircraft
  - 6.2.1 Conventional
  - 6.2.2 VTOL
  - 6.2.3 STOL

UNIT XI

6.3.0 Airborne trolleys

6.4.0 Flying trains

6.5.0 Hybrid airships

6.6.0 Giant flying freighters

6.7.0 Satellites

6.8.0 Auto radar and sonar

6.9.0 Computer-controlled traffic

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT XI: Transportation and the Future

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. List some of the advantages and disadvantages of urban transit.	A.1 Discuss material from U.S. Dept. of Transportation.
	A.2 View films on personal rapid transit.
B. Understand the present development of personal rapid transit.	B.1 Class discussion and class research reports pertaining to urban transit.
C. Describe the future plans for space transportation.	C.1 Examine space transportation in the future through readings, handouts, films, etc.
D. List and describe the technical systems that will be needed in the future.	D.1 Class lecture, handouts.
	D.2 Research and prepare a technical report on a proposed development designed for the future.

UNIT XII

Energy & Transportation

OBJECTIVES:

This unit is meant to provide the student with:

1. Knowledge concerning the consumption of energy in the human technical endeavor of transportation.

2. Knowledge about research & development activities with alternate forms of energy and steps taken to become more energy efficient.

3. A knowledge of the energy conservation options available to them & applicable to transportation.

4. A familiarization of energy efficient modes on a comparison basis.

1.0.0 Energy Consumption Patterns in Transportation

- 1.1.0 Energy consumption in transportation as compared with other uses
- 1.2.0 Energy consumption & efficiencies by environmental medias and modes

2.0.0 Energy Sources Used in Transportation

- 2.1.0 Petroleum based source & potential
- 2.2.0 Future sources
  - 2.2.1 Coal & similar non-petroleum fossil fuels
  - 2.2.2 Alternative alcohol based fuels (methanol/ethanol)
  - 2.2.3 Synthetic fuels (oil shale & tar sands)
  - 2.2.4 Hydrogen as a fuel
  - 2.2.5 Solar heat (focusing sun's rays to generate heat in some working fluid)
  - 2.2.6 Solar photovoltaic
  - 2.2.7 Nuclear fission & fusion
  - 2.2.8 Geothermal power
  - 2.2.9 Hydroelectric & wind

3.0.0 Energy Conservation Methods

- 3.1.0 Public rather than personalized transportation modes
- 3.2.0 High efficiency automobiles

3.3.0 Reduced speed limits

3.4.0 Carpooling

3.5.0 Increased passenger aircraft load factors

3.6.0 Increase walking/bicycling

3.7.0 Freight shift from trucks to rail

4.0.0 Shift Away from Internal Combustion Automobile Engines

4.1.0 Hybrid systems

4.2.0 Electric vehicles

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT XII: Energy & Transportation

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Have better understanding of the impact of the petroleum shortage on transportation.	A.1 Construct class chart of a certain fuel for the past 10 years.
	A.2 Calculate the cost per mile for operation of selected vehicles.
	A.3 Obtain information from Ford, G.M., etc. on their efforts to manufacture low MPG vehicles.
B. Identify several alternative fuels.	B.1 Discuss D.O.T. information on gasahol.
	B.2 Lab tests on small engines comparing gasahol to gasoline. Discuss results.
C. Recognize how the law of supply & demand controls the price of fuel.	C.1 Collect & discuss newspaper articles pertaining to either cost of fuel or low of supply & demand.
D. Develop & awareness of energy consumption patterns & efficiencies by various modes.	D.1 Research energy consumption and other efficiencies of six major modes of transport and illustrate the dots on a line graph.
E. Develop an energy conservation attitude.	E.1 Select one method that may be employed to conserve energy and make a specific case study to provide empirical data as evidence.

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT XII: Energy & Transportation

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
F. Develop an understanding of the potential and advantages/disadvantages of electric/hybrid vehicles.	F.1 Prepare a report on high energy rate batteries.

UNIT XIII

Transportation and the Environment

OBJECTIVES:

This unit is meant to provide the student with:

1. Information about the pollution of our environment that transportation has caused.
2. Possible corrective measures that could reverse environmental damage.

1.0.0 Pollution

- 1.1.0 Air
- 1.2.0 Water
- 1.3.0 Noise

2.0.0 Social Disruption

- 2.1.0 Accidents
- 2.2.0 Disturbance
- 2.3.0 Relocation

3.0.0 Environmental Considerations

- 3.1.0 Social
- 3.2.0 Economic
- 3.3.0 Physical and functional
- 3.4.0 Aesthetic
- 3.5.0 Interrelated

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Transportation

UNIT XIII: Transportation and the Environment

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. List some of the problems that transportation has caused for our environment.	A.1 Class discussion (newspaper, magazines articles) on air, water pollution. A.2 Class discussion. (Dept. of Transportation literature)
B. Identify the particles and gases, produced by the internal combustion engine, that cause air pollution.	B.1 Experiment with exhaust gas analyzer on lab engine.
C. List and describe some of the social disruptions that are a byproduct of transportation.	C.1 Class discussion. (Almost all will know someone either killed or injured in an accident). C.2 Describe and list some of the environmental considerations that must be weighed when evaluating transportation. C.3 Obtain and review an environmental impact study.

UNIT XIV

Occupational Information

OBJECTIVES:

This unit is meant to provide the student with:

1. Orientation and awareness of career opportunities in the area of transportation.

2. The educational requirements to acquire certain jobs in this area.

1.0.0 Occupational Information

- 1.1.0 Employment possibilities
- 1.2.0 Professional
- 1.3.0 Technical
- 1.4.0 Skilled
- 1.5.0 Semi-skilled
- 1.6.0 Un-skilled

2.0.0 OJT (On The Job Training)

3.0.0 Educational requirement

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Transportation

UNIT XIV: Occupational Information

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. List and describe some of the employment opportunities available in transportation.	A.1 Class discussion using Occupational Handbook.
	A.2 Obtain Dept. of Labor statistics on average starting salaries for specific jobs.
B. Define the term "on the job training."	B.1 Obtain some local transportation salary, and time on the job figures. Class discussion.
C. List the educational requirements for several transportation jobs.	C.1 Class lecture, handouts.

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